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UAS IN THE NAS: WHAT'S NEXT?

Wednesday, May 7, 2014

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11 am – 12:30 pm Eastern

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WELCOME TO
UAS in the NAS: What's Next?

Chuck Johnson
Senior Advisor, Unmanned and Autonomous Systems
NASA

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UAS Test Site
Program Manager
FAA

Jon Greene
Associate Director
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Virginia Tech ICTAS

Ro Bailey
Deputy Director, ACUASI
Director, Pan-Pacific
UAS Test Range Complex

Co-Moderator: Lori Dearman, Sr. Webinar Producer

Who's In the Audience?

A diverse audience of over 400 professionals registered from 50 countries, 33 states and provinces representing the following industries:

23 % System Integrator

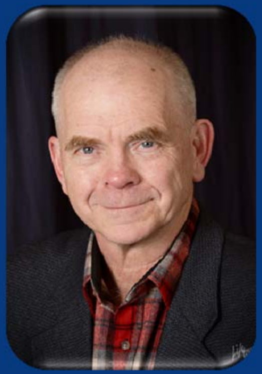
19% Professional User

13 % GNSS Equipment Manufacturer

13 % Product/Application Designer

32 % Other

Welcome from *Inside GNSS*



Glen Gibbons

Editor and Publisher
Inside GNSS

Poll #1

What is your biggest concern around UAS

- *Safety*
- *Public acceptance*
- *Standards*
- *Privacy*
- *Other*

UAS Integration in the NAS Project and Future Autonomy Research

Chuck Johnson
Senior Advisor, Unmanned and Autonomous Systems
NASA

UAS Integration in the NAS
Problem Statement

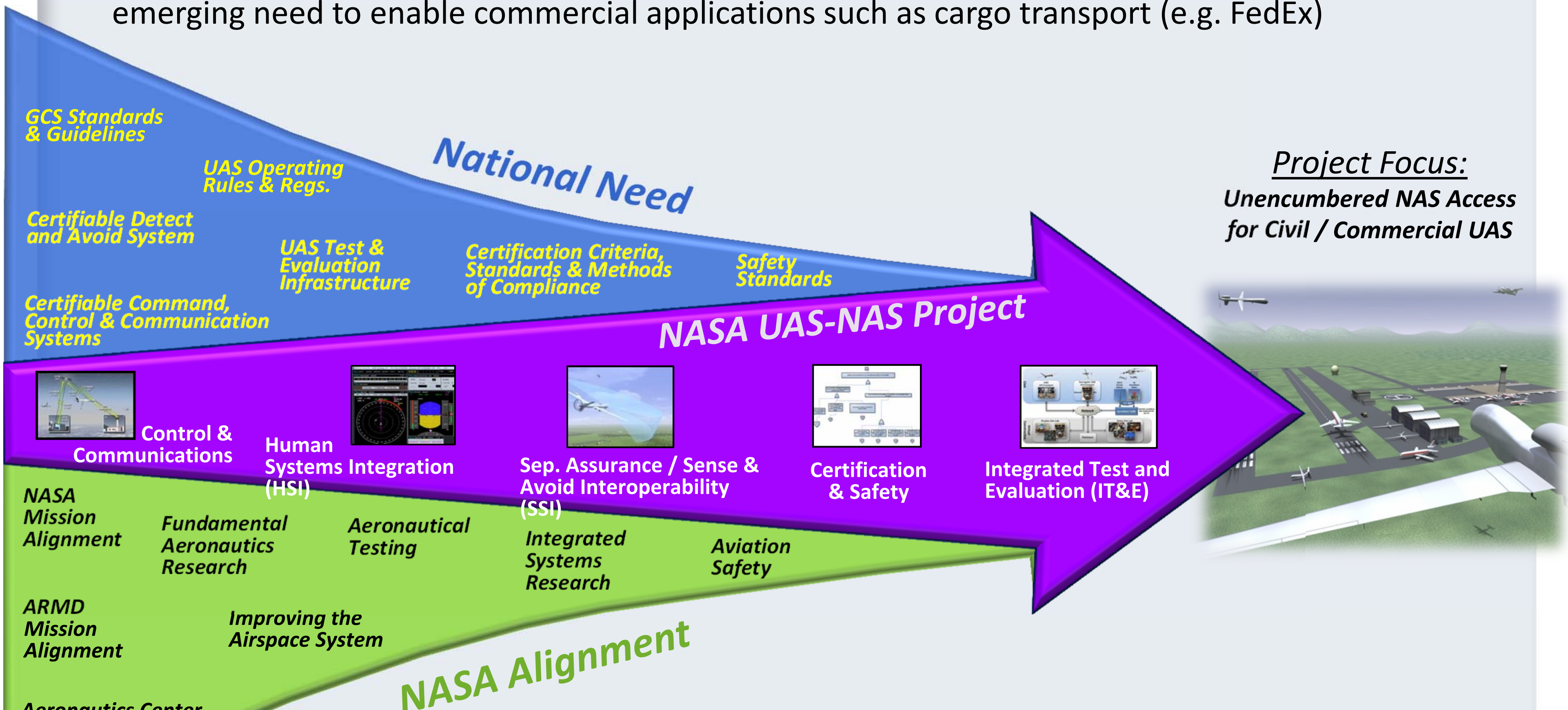
- UAS are unable to routinely access the National Airspace System today due to a lack of:
  - Automated separation assurance integrated with collision avoidance systems
  - Robust communication technologies
  - Robust human systems integration
  - Standardized safety and certification

- **There exist few regulations specifically addressing UAS. Aviation regulations are built upon the condition of a pilot being in aircraft**

- The technologies and procedures to enable seamless operation and integration of UAS in the NAS need to be developed, validated, and employed by the FAA through rule making and policy development

Developing the UAS-NAS Project

There is an increasing need to fly UAS in the NAS to perform missions of vital importance to National Security and Defense, Emergency Management, and Science. There is also an emerging need to enable commercial applications such as cargo transport (e.g. FedEx)



Provide research findings to reduce technical barriers associated with integrating Unmanned Aircraft Systems into the National Airspace System utilizing integrated system level tests in a relevant environment.

UAS-NAS Project Formulation
Key Stakeholders and Influencing Factors

Project Focus:

Unencumbered NAS Access for Civil / Commercial UAS

Groups Working on the Problem

The NASA UAS-NAS Project is influenced by several key stakeholders within the UAS Community which helped guide it's formulation

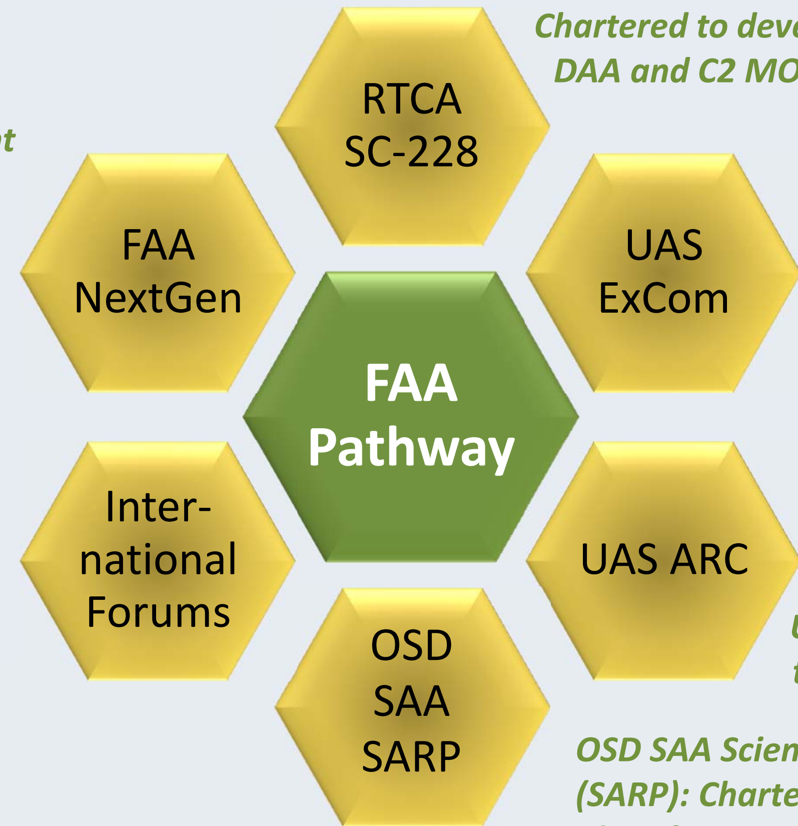
FAA Pathway to UAS Access

- The FAA is using several domestic forums, in conjunction with several international forums to lay out the pathway for their priorities and investments.
  - If work is conducted outside of the pathway, the FAA may be unwilling to collaborate

Chartered to develop DAA and C2 MOPS

Joint Planning & Development Office (JPDO): Forum where collaboration for NextGen research occurs across gov't agencies and industry

UAS Executive Committee (ExCom): Senior gov't steering group focused on streamlining public UAS access



World Radio Conference and International Civil Aviation Organization (ICAO) UAS Study Group are addressing UAS access from an international perspective

UAS Aviation Rulemaking Committee (ARC) Developed civil UAS Implementation Plan based on the FAA's UAS CONOPs & Roadmap

OSD SAA Science and Research Panel (SARP): Chartered by OSD to identify SAA Research Gaps

NASA has a leadership role within each of these forums

UAS-NAS Project OV-1

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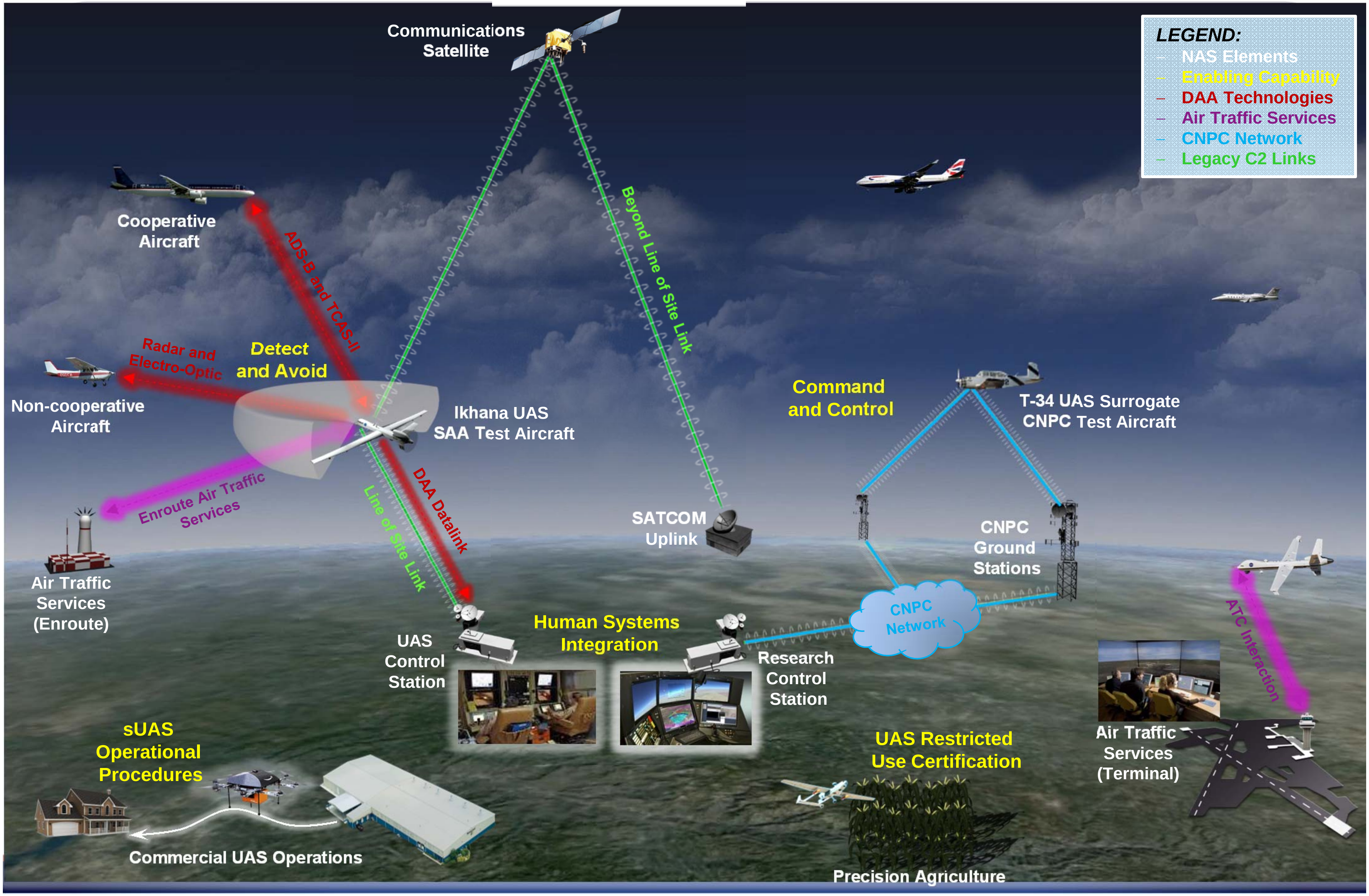
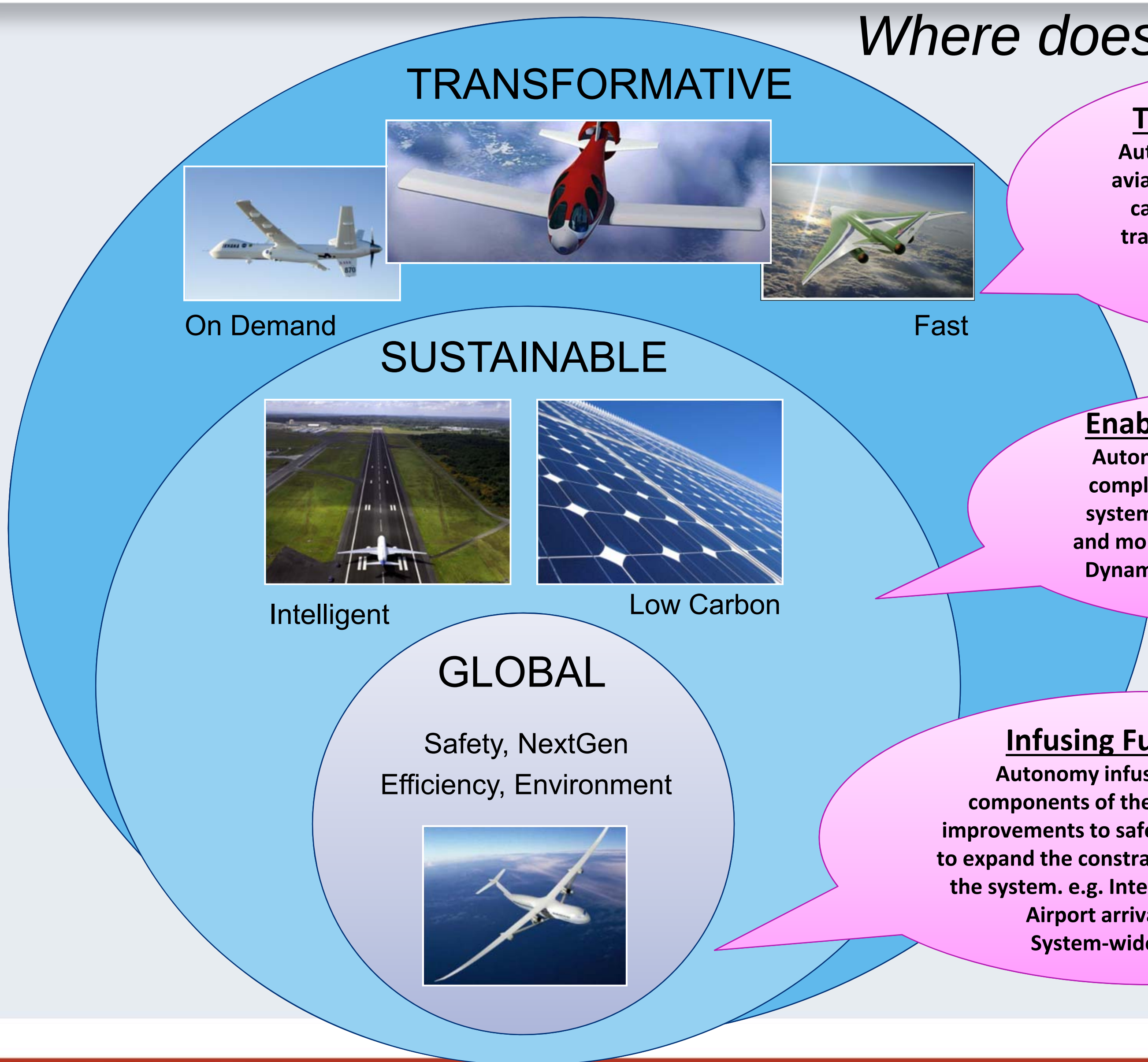


NASA'S Vision for Civil Aviation

Where does autonomy fit?



Transforming Aviation

Autonomy enabling a new overall aviation system with vastly greater capabilities such as on-demand transportation; Custom-designed and manufactured vehicles; Generalized airspace access

Enabling New Capabilities

Autonomy enabling re-designed or completely new components of the system to improve safety, efficiency and mobility. e.g. Design optimization; Dynamic routing; Intelligent mission management

Infusing Functionality

Autonomy infused into targeted components of the current system for improvements to safety and efficiency, and to expand the constraints and boundaries of the system. e.g. Intelligent flight systems; Airport arrival scheduling; System-wide prognostics

NASA's Vision for Autonomy in Civil Aviation

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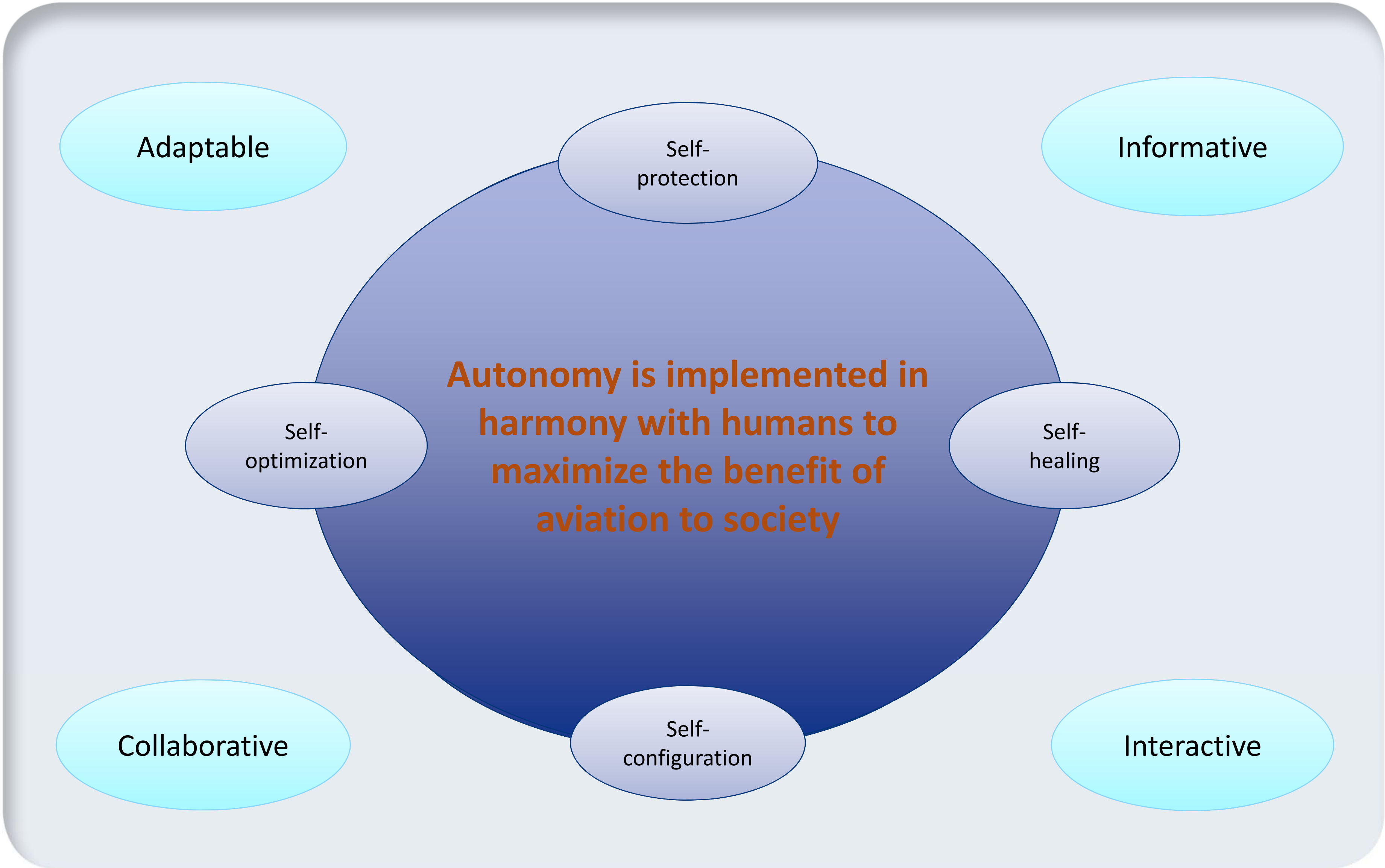

Autonomy Strategy Framework

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Vision

Autonomy is implemented in harmony with humans to maximize the benefit of aviation to society

Needs

Technologies & Applications

Develop archetypal / model autonomy standards, technologies, functions and mission applications to broadly enable innovation

Trusted Systems Integration

Address the challenges associated with trust between humans and autonomous systems

Architectures, Methods & Metrics

Develop architectures and meta-design tools that enable the efficient and effective creation of joint human-machine cognitive systems

Real World Testbeds

Establish relevant testbeds for testing autonomous systems

Challenges

Technical (Research to Enable) — Issues such as human-machine collaboration, TEV&V, machine reasoning, sensor integration, etc.

Socio-Policy (Research to Inform) — Issues such as liability, public acceptance, moral decision-making, transformation of human roles/tasks, etc.

Federal Aviation Administration

Unmanned Aircraft Systems Test Sites

Where they are today

Where they are going

Elizabeth Soltys

Elizabeth Soltys FAA's UAS Test Site Program Manager

Key Legislative Requirements in FMRA

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FAA: *"shall establish a program to integrate unmanned aircraft systems into the national airspace system at 6 Test Ranges."*

Test Range Locations: *"In determining the location of the 6 Test Ranges of the program … the Administrator shall—*

(A) take into consideration geographic and climatic diversity;

(B) take into consideration the location of ground infrastructure and research needs; and

(C) consult with the National Aeronautics and Space Administration and the Department of Defense."

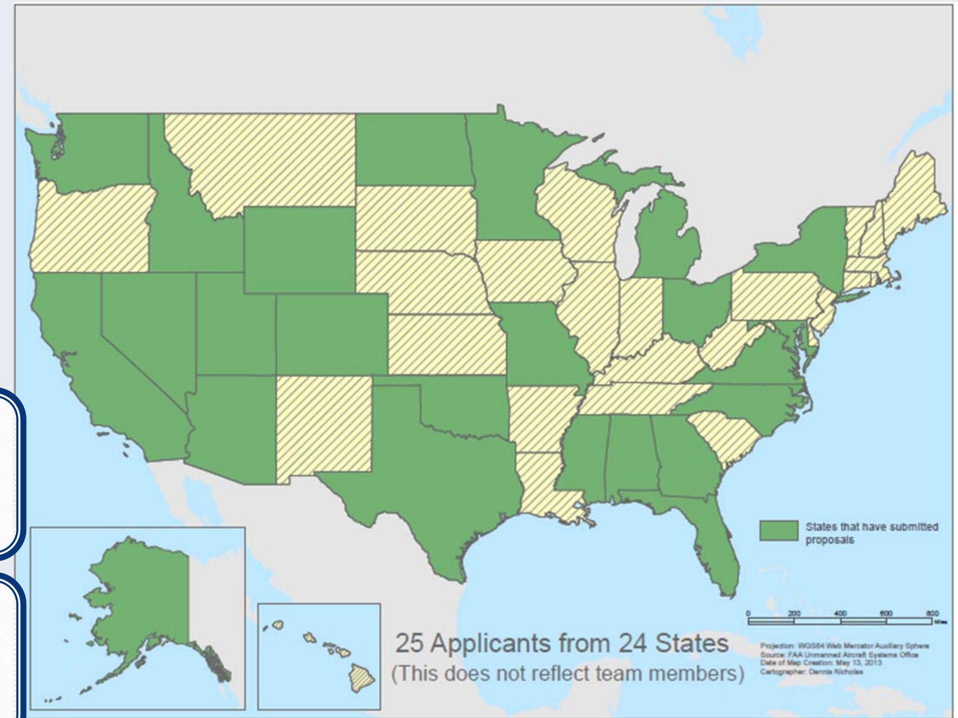
Significant Interest

Substantial Effort: Applicants & Selection Team

≈ 30,000 Pages Submitted

> 300 Airspaces Submitted

> 100 Individuals - FAA, NASA and DoD Evaluators & Advisors



Public Engagement

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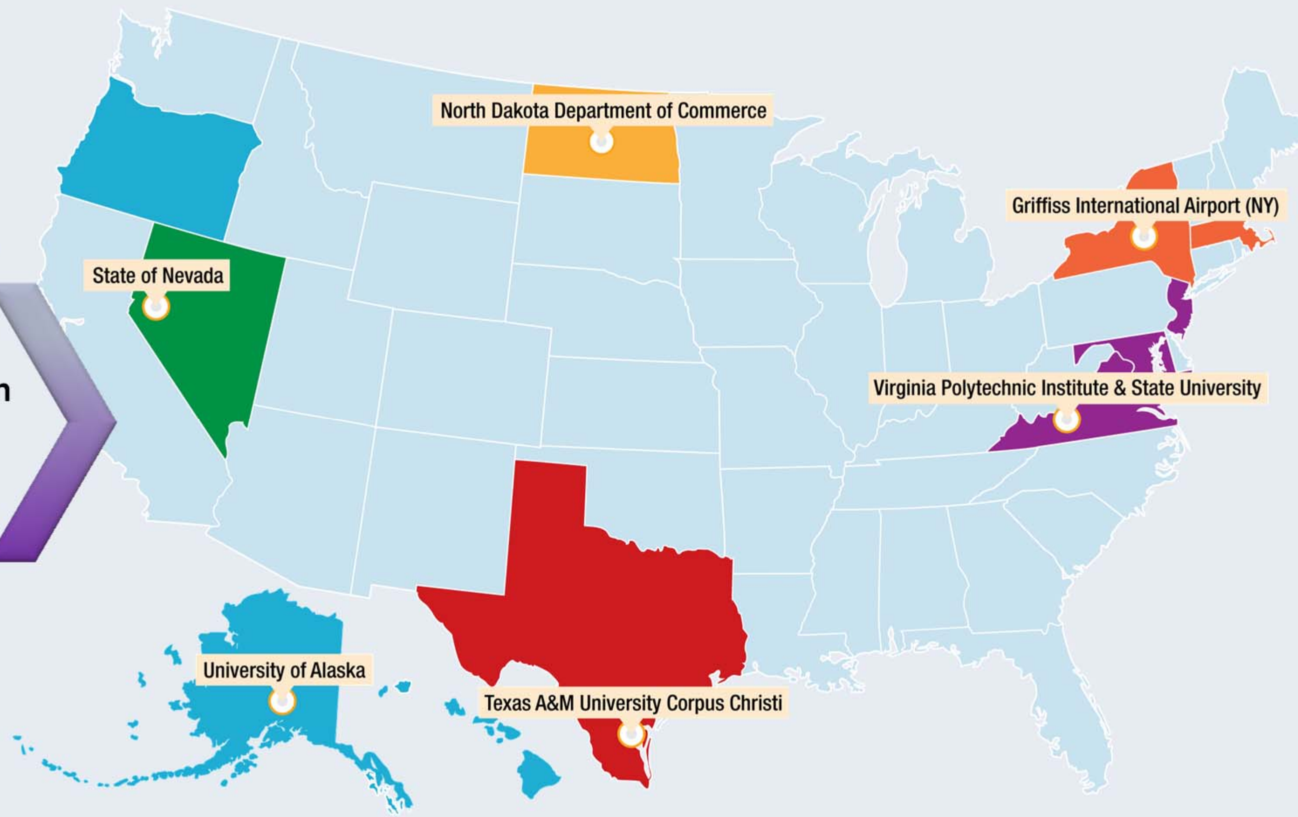
Date	Event
March 9 – May 8, 2012	RFC Unmanned Aircraft System Test Sites - 226 Questions/Comments Received
April 10 & 11, 2012	Public Webinars - Almost 800 Registrants
June 4, 2012	RFC Comments Adjudicated
February 14, 2013	FAA's Solicitation Released
February 22 – April 23, 2013	RFC Unmanned Aircraft System Test Sites Pertaining To Privacy - 101 Questions/Comments Received
April 3, 2013	Public Webinars (Privacy) - Over 600 Registrants.
November 7, 2013	Final Test Site Privacy Language Published
December 30, 2013	**6 Test Sites Selected**
March 18-19, 2014	Test Site Technical Interchange Meeting - Almost 100 Attendees hosted by the FAA's William J. Hughes Technical Center, NJ

UAS Test Site Selection Announcement

12/30/13



Selected UAS Test Site Operators

Process Beyond Selection

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UAS Test Site Selection Announcement

12/30/13

6 Months Later First Site to be Operational

- Minimum: One Applicant is Granted Authority to Operate in a Range
- Per FMRA "A project at a test range shall be operational not later than 180 days after the date on which the project is established."

Findings & Conclusions Report

5/14/17

Ahead of Schedule

2.5 Months ahead of schedule the FAA Administrator traveled to North Dakota to announce the first UAS test site was operational and has been certified to use the Draganflyer X4-ES for its testing.

"These data will lay the groundwork for reducing risks and ensuring continued safe operations of UAS. We believe the test site programs will be extremely valuable to integrating unmanned aircraft and fostering America's leadership in advancing this technology."

Michael Huerta – FAA Administrator

2 months ahead of schedule the FAA Administrator traveled to Alaska and announced that the second UAS Test Site was operational and has been certified to use the Aeryon Scout for testing.

What's Next – Steps Towards Integration

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FAA developing

Research Activities

Test Sites to receive broader COA for public aircraft operations

FAA to delegate Test Sites authority to issue Airworthiness Certificates for civil operations

Findings & Conclusions Report 5/14/17

Based on each Test Site's proven experience and safety acumen

Trusted Relationship!

Ask the Experts – Part 1

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Poll #2

What do you think will be the leading commercial applications of UAS in the next five years?
Select your top 2

- *Environmental-Precision agriculture*
- *Photography for film/media/news/traffic*
- *Communications Networks*
- *Personal air vehicles for transport of humans*
- *Door to door transport of goods*

Poll #3

What do you think will be the leading commercial applications of UAS in the next twenty years?
Select your top 2

- *Environmental-Precision agriculture*
- *Photography for film/media/news/traffic*
- *Communications Networks*
- *Personal air vehicles for transport of humans*
- *Door to door transport of goods*

Alaska Center For Unmanned Aircraft Systems Integrations RDT&E

Ro Bailey
Deputy Director, ACUASI
Director, Pan-Pacific UAS Test Range Complex

Unmanned Aircraft Systems for Alaska

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Geophysical Institute
University of Alaska Fairbanks

Alaska - Perfect for Unmanned Aircraft Systems

Mission Statement

A research center for small, unmanned aircraft systems providing integration of unique payloads and supporting pathfinder missions within government and science communities, with a special emphasis on the Arctic region

Conducted over 150 mission flight days worldwide in 2012/2013

What Can UAS Be Used For?

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- **Civilian applications**
  - Research data collection
    - Universities, Federal & state agencies, private businesses
  - Mapping
    - Government agencies, mining & oil industry, surveyors, archeologists,
  - Emergency assessment & response
    - Earthquake, tsunami, avalanche, wildfire, search & rescue
  - Environmental assessment
    - Precision agriculture, species monitoring, herd management, spill response
  - Law enforcement:
    - Forensic scene mapping, traffic accident clearing, hostage situations
  - Commercial interests:
    - Real estate, property inspection, surveying, photo tours, deliveries, and more

All UAF work is research

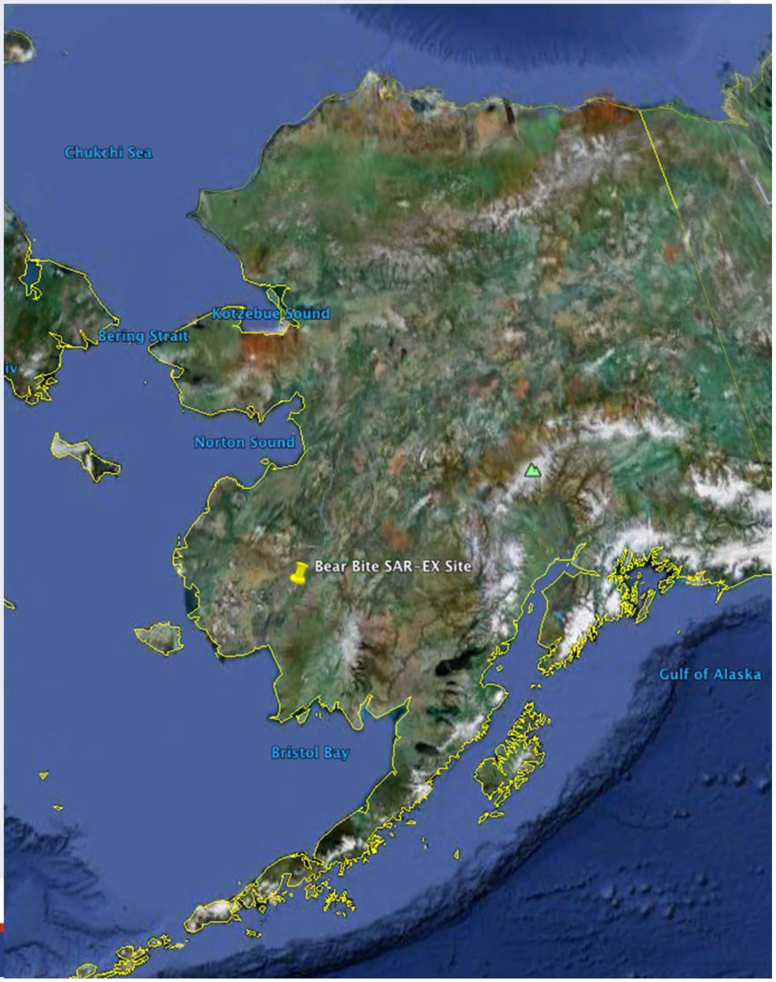
"An aircraft crashed in the tundra roughly 20 miles outside Bethel Alaska many died with some survivors"

Deployed two unmanned aircraft systems with support team

Coordinated with manned aviation on the scene

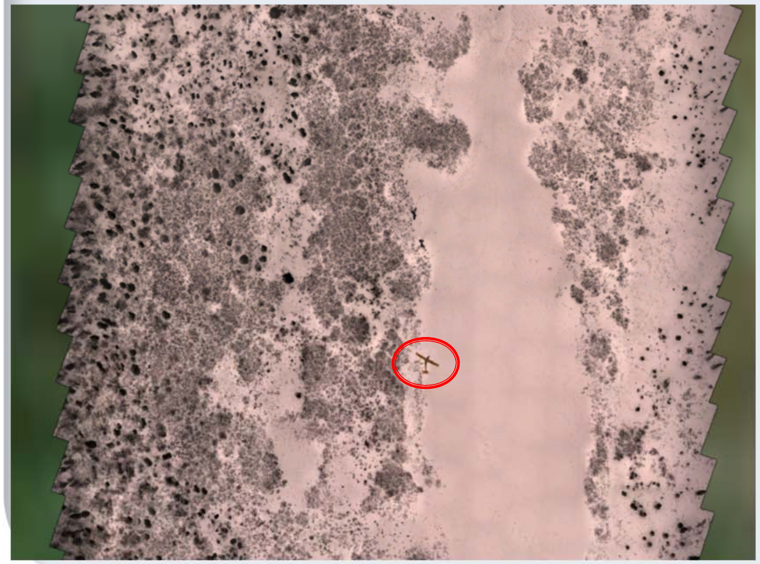
Mission:

- **Map scene for event documentation**
- **Real-time Search and Rescue**
- **Assess utility of UAS for this mission**



Bear Bite - SAREX

"I've worked with the MQ9 and the MQ1 before and when compared these products were pretty sweet" – SAR Duty Officer statement at after action review 11 Feb 2013. "Within just a couple hours imagery was collected and turned into mosaic products in the field"



Researching Utility of UAS in Extreme Conditions

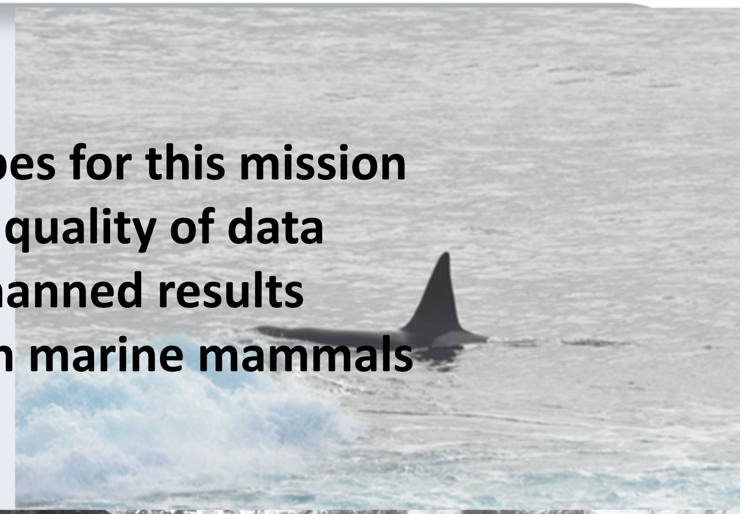
Mission

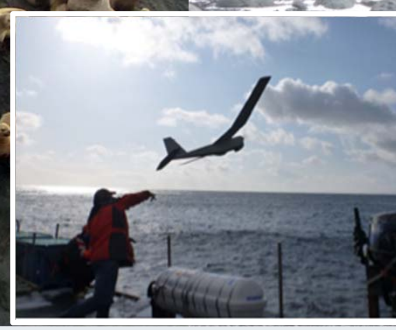
1. Identify potential safety concerns for those working on the ice
2. Document the site for mission response activity
3. Collect imagery for the USCG records, lessons learned

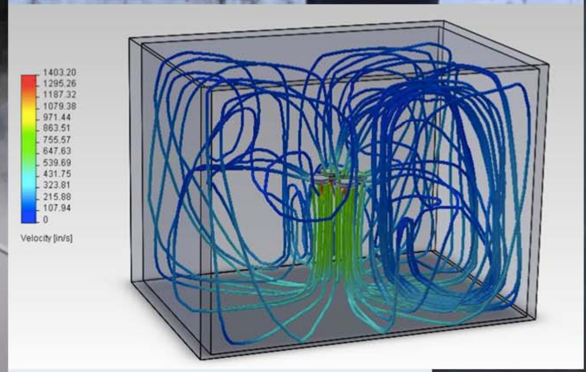
Steller Sea Lion Habitat Monitoring

Research Goals

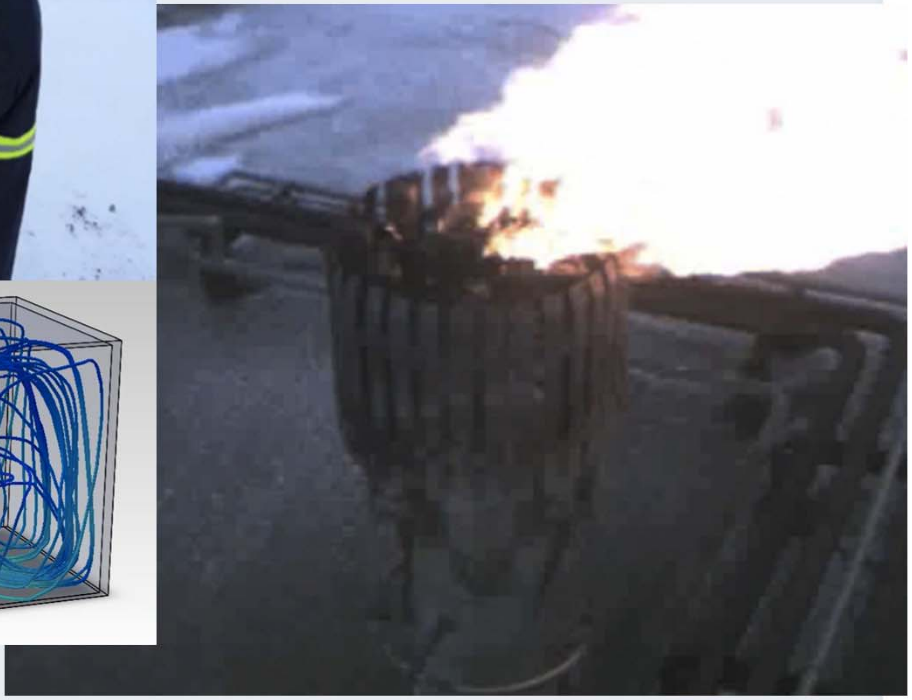
- Assess 2 UAS types for this mission
- Assess quantity, quality of data
- Compare with manned results
- Assess impact on marine mammals







- Flare Stacks
- Pipelines
- Processing Facilities
- Access Roads



Assessing utility of UAS for infrastructure inspection, spill/leak detection

- **All under extreme weather conditions, strict environmental rules**

Sample of Potential Projects for 2014-15

- Southern Company & Idaho Power
- Oil Companies (multiple)
- Whale research
- Test missions for PPUTRC (multiple inquiries)
- Sikuliaq Ice Trials for better ice navigation
- Methane sensor test & hydrates mapping
- North Slope Borough demonstrations
- Reduce noise, visual intrusion on Native villages of manned aviation
- Oklahoma power & energy opportunities
- Moose & Dall sheep surveys
- Forestry, FEMA – response to wildfires
- Fish counting
- Firefighter & law enforcement officer training
- Precision agriculture in Oregon

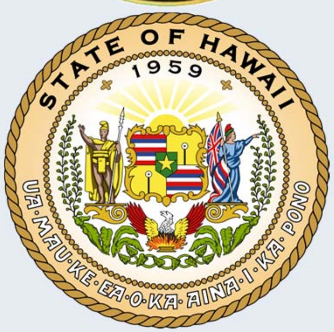
Integration of UAS into the NAS

- FAA Concerns
  - See or sense & avoid
  - UAS certification
  - Operator licensing
  - Interaction with manned aviation & NAS protocols
- Pathway to resolution of concerns
  - Safety studies
  - Standards
  - Technology
  - Data + analysis
- Via: FAA Test Sites

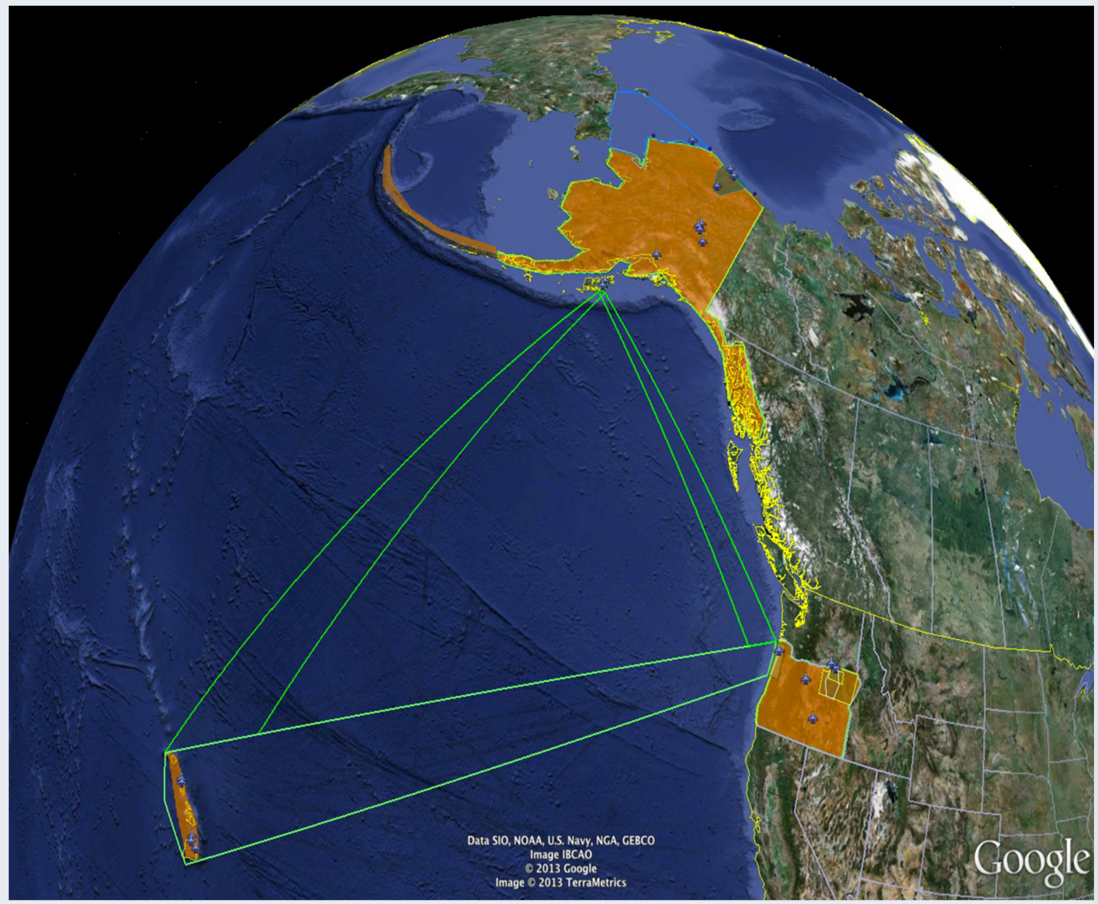
Pan Pacific UAS Test Range Complex (PPUTRC)

Alaska

Oregon



Hawaii



FAA Test Site

- University of Alaska is lead
- Principal team includes States of Alaska, Oregon, and Hawaii
- Plus 56 participating team members
  - State agencies
  - Universities
  - Corporations & small business
  - Native groups
  - Aviation associations
- International partners – especially Iceland
- Concept: dual tracks to capture data useful to FAA
  - Clients desiring to test UAS & related equipment
  - Projects under ACUASI – every mission offers data opportunities

Arctic Area per the FMRA Plan

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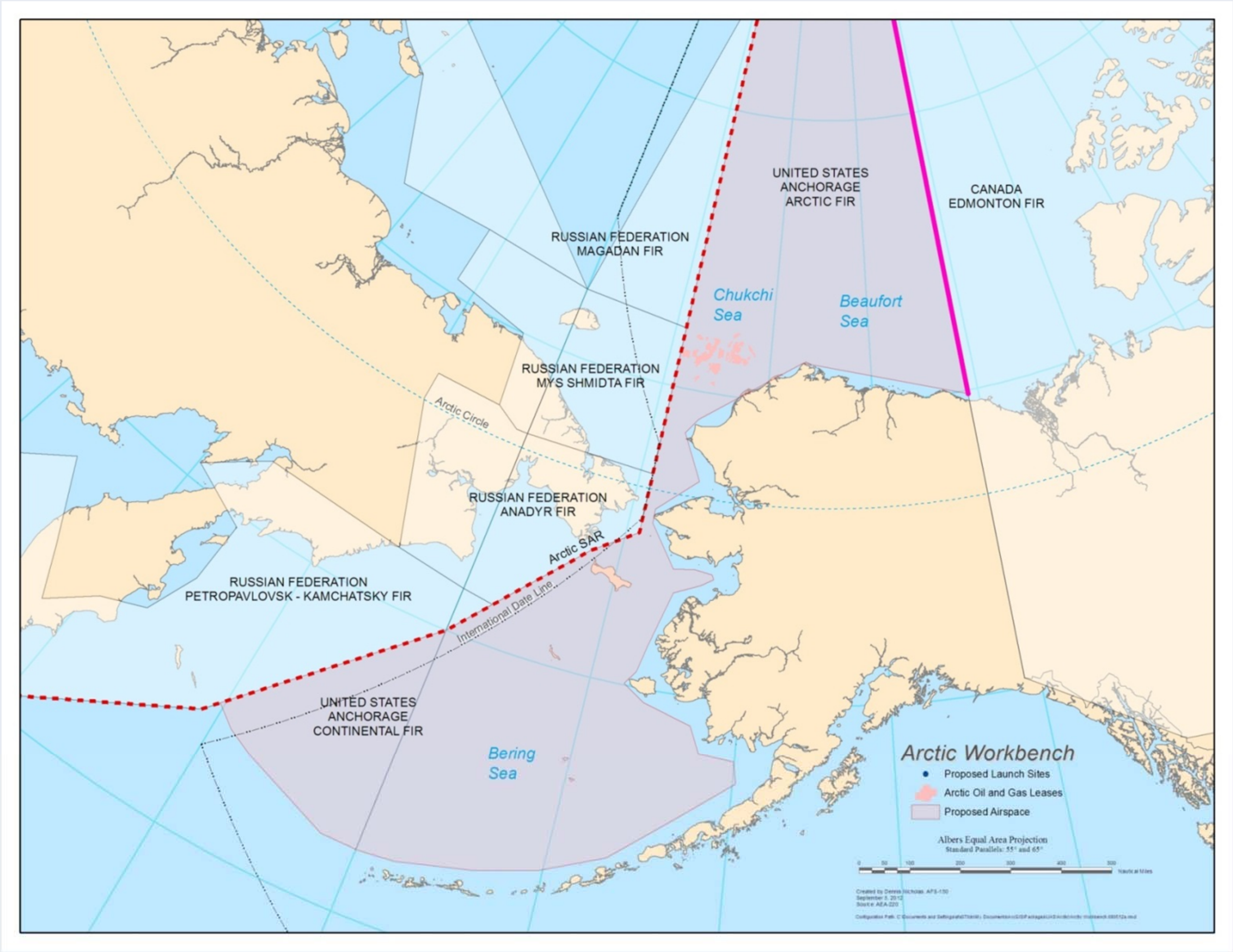

Expanding Use of Unmanned Aircraft Systems in the Arctic SEC 332 (d)

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"…. the Secretary shall develop a plan and initiate a process to ….designate permanent areas in the Arctic where small unmanned aircraft may operate 24 hours per day for research and commercial purposes."

- ''Arctic'' means the United States zone of the Chukchi Sea, Beaufort Sea, and Bering Sea north of the Aleutian chain.
- Designate permanent areas in the Arctic where small unmanned aircraft may operate 24 hours per day for research and commercial purposes.
- Operations in these permanent areas shall include the development of processes to facilitate the safe operation of unmanned aircraft beyond line of sight.
- Such areas shall enable over-water flights from the surface to at least 2,000 feet in altitude, with ingress and egress routes from selected coastal launch sites.
- Approving the use of unmanned aircraft in the designated permanent areas in the Arctic without regard to whether an unmanned aircraft is used as a public aircraft, a civil aircraft, or a model aircraft.

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- Approving the use of unmanned aircraft in the designated permanent areas in the Arctic without regard to whether an unmanned aircraft is used as a public aircraft, a civil aircraft, or a model aircraft.

In short, small UAS may operate 24/7 up to at least 2000 feet, access to & from selected coastal launch sites, for all users and uses, in permanent airspace from the Aleutians to the Canadian boarder

- FAA working with industry enabled first commercial (non-COA) flights
  - But entirely using the military exception
  - Great interest from industry operating in this area
  - Concern from aviation operators
- Not yet formed, but expect to collaborate to gather needed data for UAS certification for this effort
  - Test site mission clearly fits
  - UAF location ideal
  - ACUASI projects can help with data
  - PPUTRC missions can directly apply

In Summary…

- ACUASI is assessing & demonstrating UAS civilian utility
- PPUTRC (and other test sites) will accelerate data collection for FAA integration efforts
- Arctic Airspace effort adds dimension & further accelerates integration
- Someday we might see this...

Maybe someday?

A flying sushi service tray known as the "iTray," created using miniature remote-controlled helicopter rotor blades, is demonstrated by staff at a Yo Sushi restaurant in London on June 10, 2013

Photo by Neil Hall / Reuters

UAS Flying in the National Airspace?

How do we get there?

Jon Greene
Associate Director
Strategic Planning and Development
Virginia Tech ICTAS

Is The End State

This?

Or This?

Maybe This?

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Six Test Sites (and others) engaged in research, development, experimentation and demonstrations.

Result: Data that permits risk informed decisions

Step 1: Small UAS/Visual Line of Sight

Timeline: 2-3 years

Limitations:

- Low risk airspace
- Altitude
- Distance from airports

Applications:

- Agriculture
- Emergency response
- Some infrastructure inspections
- Imagery

Challenges:

- Technological: The uncooperative aircraft
- Policy: UAS and Pilot certification

Small UAS rules to be delivered for comment in November 2014.

Step 2: Small UAS/Beyond line of site

Timeline: 3-10 years

Limitations:

- Low risk airspace
- Altitude
- Distance from airports

Applications:

- Emergency response
- Infrastructure inspections
- Wildlife, fisheries management

Challenges:

- Technological: Detect and Avoid
- Policy: UAS and Pilot certification

Step 3: High Altitude/Long Endurance

Timeline: 5-15 years

Limitations:

- High Altitudes
- Distance from airports

Applications:

- Communications
- Imagery

Challenges:

- Technological: Platform challenges
    - Transit to altitude
- Policy: UAS and Pilot certification

Step 4-10: Gradual Evolution

Timeline: 5-20 (or more) years
Gradual easing of restrictions on
    what can fly
    where it can fly
Applications:
    Many that we haven't yet anticipated?
Challenges:
    Technological: Spectrum/Cyber
    Policy: Dedicated pilot? Role of autonomy?

Summary

- Expect a relatively slow roll out of UAS technologies
- There are some technical challenges
- Largest obstacles are policy

Next Steps

Visit www.insidegnss.com/webinars for:

- PDF of Presentation
- Resources

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